Statement by

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Regarding

Carbon Sequestration: Risks, Opportunities, and Protection of Drinking Water

submitted to

The U.S. House

Committee on Energy and Commerce

Subcommittee on Environment and Hazardous Materials

We appreciate the opportunity to speak to you today as the Committee examines the regulatory framework necessary for carbon sequestration, particularly measures that need to be taken to protect underground sources of drinking water. We also appreciate the

opportunity to make a few comments regarding capacity assessments for the sequestration of carbon dioxide in geological formations. Climate change is the most important environmental issue of our generation and successful development and deployment of geologic sequestration is a critical path for accommodating coal, the world's most abundant but carbon-intensive fossil fuel, to a carbon-constrained future.

Environmental Defense Fund (EDF) is a national non-profit organization representing more than 500,000 members. Since 1967, we have linked science, economics and law to create innovative, equitable and cost-effective solutions to urgent environmental problems. My personal background includes more than 20 years representing independent oil and gas producers in Texas, and so I have some appreciation for many of the issues and concerns related to the underground storage of carbon dioxide.

The House is doing important work to address the threat of climate change. The single most important thing the House can do to further the geologic sequestration of CO2 is to take action on cap and trade legislation, since such legislation would create a market value and a market mechanism for avoiding carbon dioxide emissions. Given the right incentives, we believe that the market will be far more effective and efficient in discovering necessary technologies of all types, including carbon capture and storage (CCS), than any suite of government mandates or subsidies, however well intentioned.

Also vital is your interest in determining what regulatory measures are needed for geologic sequestration to satisfy the goals of the Safe Drinking Water Act. Without a

sound regulatory framework, geologic sequestration of carbon dioxide could fail to live up to its promise and in fact lead to additional environmental problems. CO2 sequestration cannot be done everywhere and projects must be properly managed in order to be safe and effective. For good reason, public acceptance of CCS will happen only if the public is confident that rigorous and credible regulatory oversight is in place. Fortunately, developing sound regulations for geologic sequestration appears to be within our grasp and the country is making excellent progress toward achieving this goal.

The fact that Environmental Defense Fund supports the deployment of CCS does not mean that we are champions of coal. We are pleased that people are increasingly recognizing that energy efficiency and renewables should play a leading role in energy and climate policy. As indicated by McKinsey and Company's U.S. Greenhouse Gas Abatement Mapping Initiative, there are many efficiency and renewable energy strategies that are cost-effective and can be pursued even before CCS is a fully developed, commercial enterprise. CCS is an important part of the solution, but it is only a part.

Although we are not champions of coal at EDF, we are realists. Market forces dictate that coal will continue to be used for electricity production for the foreseeable future regardless of whether its share of the market goes up or down. Therefore the nation and the world need technologies that enable coal to be used in a manner that avoids significant greenhouse gas emissions. According to an IEA study released in 2006, CCS could rank, by 2050, second only to energy efficiency as a greenhouse gas control measure. The Intergovernmental Panel on Climate Change (IPCC) projects that CCS

could, by 2100, contribute 15 to 55% of the greenhouse gas reductions needed to avert catastrophic climate change.

I would like to cover several things this morning. My main focus will be to suggest what regulatory elements are needed in order to manage the risks of geologic sequestration, particularly risks that are relevant to the protection of groundwater. I will offer a preliminary assessment of the proposed rules released last week by EPA. I also will comment briefly on progress being made in assessing the nation's geologic capacity for CO2 sequestration. Finally, I will offer a few observations on liability issues since there is a relationship between an effective regulatory program and the broader legal context in which such regulation takes place.

Regulatory Considerations – Measures Needed to Protect Underground Sources of Drinking Water

Geologic sequestration of carbon dioxide is feasible under the right conditions. It has been successfully demonstrated in a number of field projects, including several large projects. The IPCC Special Report on Carbon Capture and Storage concluded in 2005 that the fraction of CO2 retained in "appropriately selected and managed geological reservoirs" is likely to exceed 99% over 1000 years. The IPCC also concluded that the local health, safety and environmental risks of CCS are comparable to the risk of current activities such as natural gas storage, enhanced oil recovery and deep underground storage of acid gas *if* there is "appropriate site selection based on available subsurface

information, a monitoring programme to detect problems, a regulatory system and the appropriate use of remediation methods to stop or control CO2 releases if they arise."

While there is little doubt that geologic sequestration is feasible, and little doubt that successful projects are technically achievable today, knowledge and understanding are expected to increase dramatically as the technology begins to be deployed on a large scale. Current projects are highly customized. Neither government nor industry have yet developed standard protocols for fundamental aspects of the process such as site characterization and monitoring. In fact, due to geologic variability both between and within sites, project design will always need to be site-specific to a significant degree. Still, the IPCC Special Report projects that increasing knowledge and experience will "reduce uncertainties" and "facilitate decision-making."

In other words, we know enough to get started but we can expect to experience a lot of "learning by doing."

What are the implications of this for the regulatory system? We believe at least four recommendations are in order to account for the fact that increasing knowledge and experience will facilitate rational decision-making in different ways over time:

- Lean toward a performance-based system. "Performance-based" regulations and "command-and-control" regulations *do* co-exist -- they are two poles on a continuum;

- Be reasonably flexible. Different projects will present different risks and uncertainties, and the uncertainty presented by a single project will tend to decline over time;
- Require projects to employ an iterative process, informed by monitoring results and perhaps even by experience gained from other projects, in order to reduce uncertainty and drive improvements in site characterization, site suitability assessment, models, model inputs, field operations, the monitoring plan itself, and the remediation plan;
- Write "adaptive" rules. Look for language that automatically accommodates evolving best practices. Also structure rules to make use of evolving knowledge at each particular site. Be willing to amend rules when needed to protect the environment, giving due regard to the fact that it generally is in the public interest for the regulatory framework to give the regulated community the certainty needed to make investment decisions.

These general recommendations are important, but it is not enough for rules to be flexible, adaptive and performance-based. It is essential that rules be grounded in a thorough, scientific understanding of the risks involved and that rules assure that the risks will be managed properly. In order to accomplish this, some aspects of the rules (e.g. site characterization and site selection requirements) will need to be more prescriptive than others and the regulatory program must always remain focused on assuring that underground sources of drinking water are not endangered.

How should this focus on protecting underground sources of drinking water be maintained? Regulations governing the geologic sequestration of carbon dioxide must include clear and rigorous standards relating to:

- Site characterization and selection (including modeling, capacity estimates for long-term retention, and risk assessment)
- Operations (including well construction and maintenance, injection practices, purity of the injection stream, monitoring, reservoir pressure management, reporting requirements, and preventive action and/or corrective action as necessary)
- Periodic adjustments over the life of the project regarding any of the above elements if appropriate based on project experience
- Closure procedures
- A post-closure determination that the project does not and will not endanger USDWs

EPA's Proposed Rules for Geologic Sequestration

How well do the proposed rules that EPA released on July 15 meet these criteria? EDF is still in the preliminary stage of evaluating the proposal, but it is clear that the rules have much to say about each of the regulatory elements just mentioned. The Agency appears to have thoroughly reviewed most of the issues involved and attempted to craft a set of rules that is both protective of the environment and not unduly burdensome for industry. EDF will undoubtedly develop many recommendations for adjustments during the public

comment period, including recommendations of fundamental importance, but overall we are pleased at this stage with what we have seen.

Although we are still at an early stage of assessing the proposal, we can offer the Committee some specific comments at this time. For convenience, I will divide our observations into positive comments and not-so-positive comments. First the positive:

1. We believe that the proposal to create a new Class VI category for long-term geologic sequestration of carbon dioxide is a good idea. Creating a separate category is justified by the differences between long-term sequestration and other injection operations – differences that relate to scale, duration, and pressure regimes, and perhaps by other differences as well. Section 146.81(a).
2. Because of the differences just mentioned, we believe that EPA is right to propose to maintain different regulations for Class II wells used for enhanced oil recovery projects. If such wells begin to be used for the purpose of long-term sequestration, Class VI regulations would generally apply at that time. See section 146.81(c).
3. The proposal defines the Area of Review (AOR) to include the entire area that may be impacted by the injection activity, rather than defining the AOR according to a fixed radius around injection wells as is sometimes done in the Underground Injection Control (UIC) program. This is a good and important proposal because of the potentially large areal extent of sequestration projects and the risks that may be present due to elevated pressure. Section 146.81(d).

4. Although some adjustments are probably in order, the scope of information that the proposed rule would require as part of a Class VI permit application appears to be generally reasonable. Section 146.82.

5. Similarly, although some adjustments are probably in order, the proposed minimum criteria for siting appear to be generally reasonable. The criteria have much in common with both established (UIC) principles and with specific recommendations made by stakeholder groups such as the Interstate Oil and Gas Compact Commission and the Ground Water Protection Council. Section 146.83.

6. While once again some adjustments are probably in order, another positive and important provision is the proposal to require a testing and monitoring plan to verify that the sequestration project is operating as permitted and is not endangering USDWs. Section 146.90.

7. The proposed rule properly avoids relying on the simple absence of known problems over a given amount of time following cessation of injection as the basis for determining that USDWs are not being endangered. Section 146.93.

8. The proposed rule includes emergency and remedial response requirements that are clear and rigorous. If an operator obtains evidence that the injected carbon dioxide steam and associated pressure front may endanger a USDW, the operator must immediately cease injection, take all steps reasonably necessary to characterize any release, notify the permitting agency within 24 hours, and follow previously approved plans to address movement of injection or formation fluids. Section 146.94.

We offer the following preliminary comments regarding aspects of the proposed rules that may merit adjustment:

1. Although the proposal defines the Area of Review as the region that may be impacted by the injection activity, the proposed methodology for determining this region may not focus adequately on the potential effects of elevated pressure and displaced brine, as distinct from effects of the carbon dioxide itself. Section 146.81(d).
2. The proposal should take a more sophisticated approach to regulating injection pressure. Injection pressure limitations need to take account of the possibility that under certain conditions faults that would otherwise be nontransmissive can become transmissive even if injection pressures are kept below the level necessary to create new fractures or propagate existing fractures. No single across-the-board pressure limit, including the proposed requirement that injection pressure not exceed 90 percent of fracture pressure, is adequate for this purpose. See section 146.88(a).
3. Although the proposal properly avoids using the simple absence of known problems over a given amount of time as the basis for determining that USDWs are not being endangered following the cessation of injection, the requirement that the carbon dioxide plume and pressure front be "stabilized" in order to make this finding is probably not appropriate as a general standard. The World Resources Institute is in the process of completing a set of

Guidelines that may prove helpful on this important issue. See section 146.93(b).

Geologic Storage Capacity Assessments

EDF commends the Department of Energy's Regional Sequestration Partnership Program for developing the Carbon Sequestration Atlas of the U.S. and Canada. And we look forward to the more detailed assessments of long-term storage capacity contemplated by the USGS. It is important, however, to understand the purposes for which such studies are and are not useful. Regional assessments can provide general information about where appropriate sequestration sites may be located. They can provide regional capacity estimates that are either more or less accurate depending on the type of analysis that is undertaken. Regional assessments cannot, however, confirm that a particular site is or is not suitable for a sequestration project. Determining the suitability of a site necessarily requires extensive data collection and geologic characterization specific to the location under consideration.

Liability Rules and the Regulation of Geologic Sequestration

A number of people appear to take it as a forgone conclusion that "liability relief" is necessary in order for a geologic sequestration industry to develop. Those holding this view are rarely specific about the "liability relief" they have in mind. EDF is not convinced that any "liability relief" is needed for the carbon dioxide sequestration

industry in the long run, although we are open to exploring the possibility of special rules and institutions for early projects (e.g., liability limits for individual companies in carefully defined situations coupled with an industry-funded risk pool to cover damages in excess of such limits).

We would offer the following observations on the subject of "liability relief":

- Privatizing benefits while socializing risks is a good way to incentivize inefficient and even dangerous behavior.
- Current liability rules grounded in common law and statutes serve an important purpose – encouraging people to act as their fellow citizens and policymakers expect them to act.
- There is no special "liability relief" for the enhanced oil recovery business or the underground injection of hazardous waste business. Natural gas storage is not subject to UIC regulations, but natural gas storage operators are not shielded from liability as a general matter. Yet all three of these businesses inject material into geologic formations and appear to have little trouble attracting investment in the marketplace.
- If liability rules incentivizing good behavior were absent, regulators might perceive a need to adopt rules that were more detailed and prescriptive than would otherwise be the case.
- Those who advocate modification of liability rules for carbon sequestration ought to be clear about *what* liabilities they would like to see addressed. Do they mean to include liability for contract violations, fraudulent acts, or

conversion of other people's property? Do they mean to include liability for intentionally inflicted harms or gross negligence? Do they mean to include all types of damages or just certain types of damages?

- It is one thing to transfer the risk of liability for a well-executed sequestration project, and something else entirely to relieve an operator who has created a project that presents significant risks. In order to distinguish between these situations and maintain incentives for workmanlike behavior, we believe that the nature and perhaps the existence of any liability modification should depend on whether a project demonstrates following closure that there is a high degree of certainty that USDWs are not and will not be endangered.
- A useful way to think about possible modifications of liability rules applying to geologic sequestration activities would be to ask what novel risks are presented by this activity, the extent to which these risks can be handled in the current marketplace (e.g., insurance, investors shouldering risk in expectation of a higher return), and the extent to which it might be possible and desirable to create new private sector mechanisms (e.g., industry risk pools, new forms of insurance) to address any real problems with capital formation.
- In the event it is found that investment in geologic sequestration is unreasonably hampered by risk management issues, the solution should be tailored to fit the problem and to the extent possible the solution should make use of market mechanisms and risk-sharing within the industry.

Conclusion

In a carbon-constrained world where market forces are harnessed to make sure that society's carbon footprint is reduced in an economically rational fashion, Environmental Defense Fund foresees a dramatically increased role for renewable energy and for energy efficiency. At the same time, since any complete transition away from fossil fuels is likely to take a very long time, we foresee a long-term need to deal with CO2 emissions from coal-based facilities. The sooner we begin to deploy CCS technology on a large scale the better. We applaud you for working on measures to make this a reality.